LIDAR

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What is LIDAR?

-Remotely Sensed Elevation Data

Why Would You Want LIDAR?

-High Accuracy (15cm ~ 6in)

-High Spatial Resolution (1-2m)

-Can be Collected in Vegetated Areas

-Cost Effective

LIDAR (LIght Detection And Ranging)

Laser:

Pulsing thousands of times per second

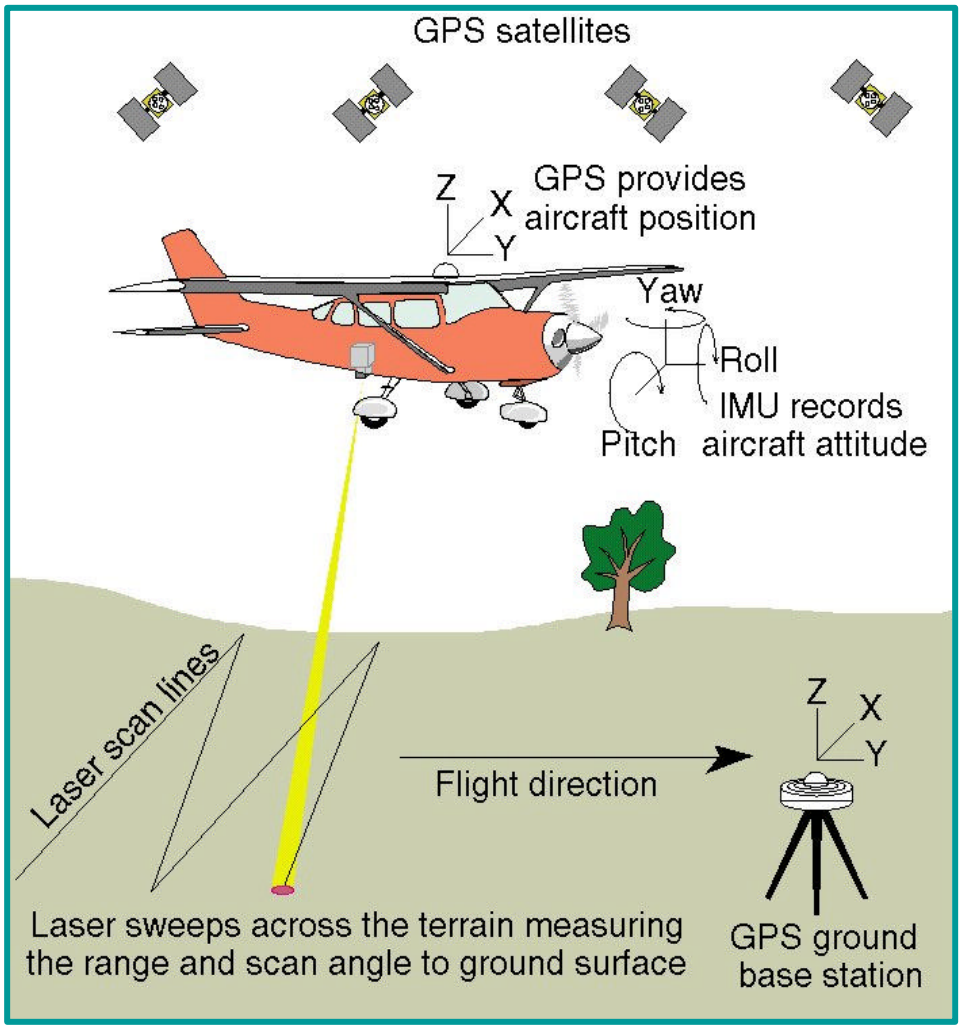
GPS:

Provides the exact location on the aircraft

IMU:

An Inertial Measurement Unit used to remove the effects of Roll, Pitch and Yaw

All three data streams (laser ranges, IMU information, and GPS positions) are merged and processed to generate a series of topographic points.



LIDAR System

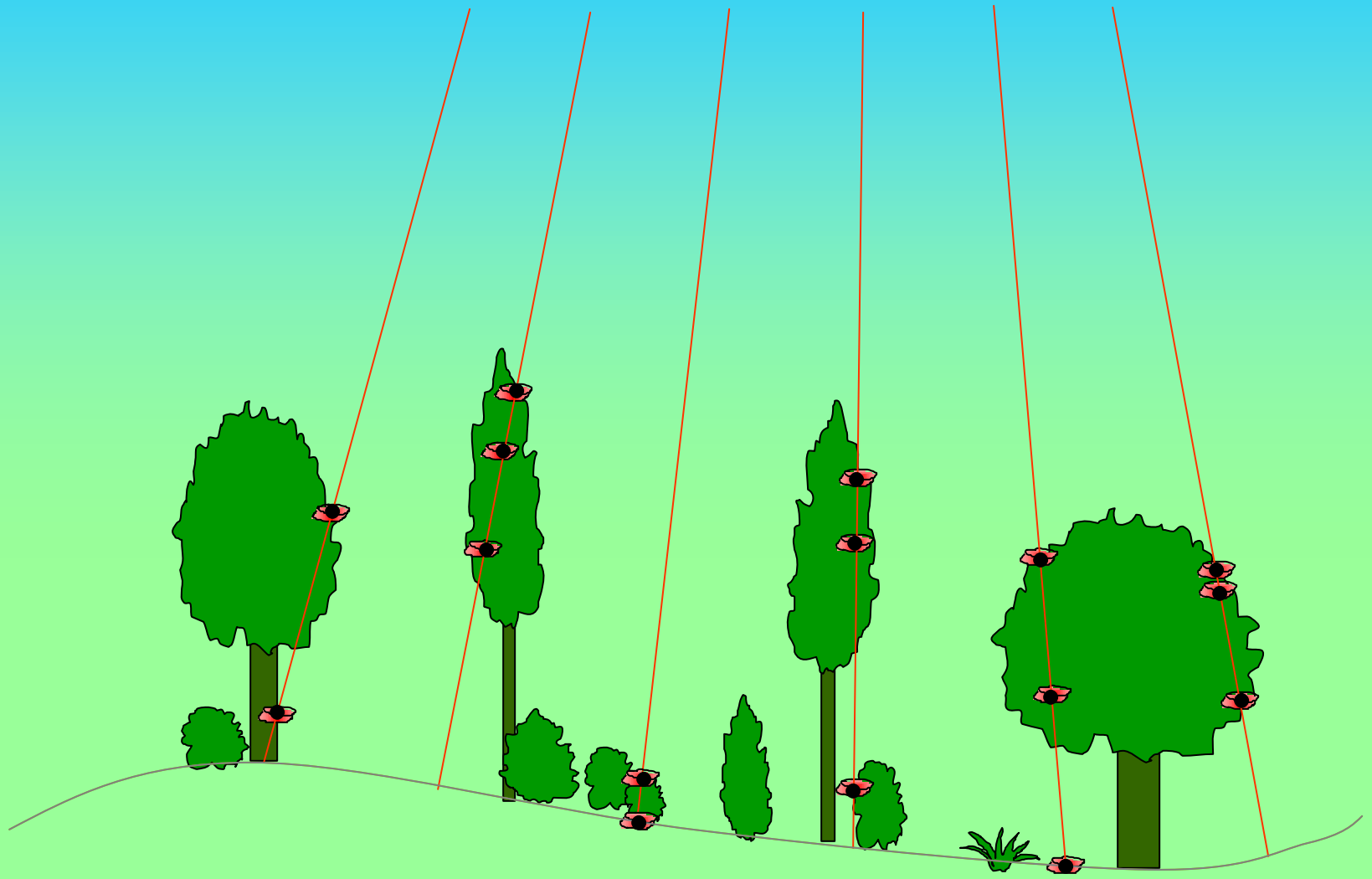
-Laser pulse rate: up to 25,000 per sec.

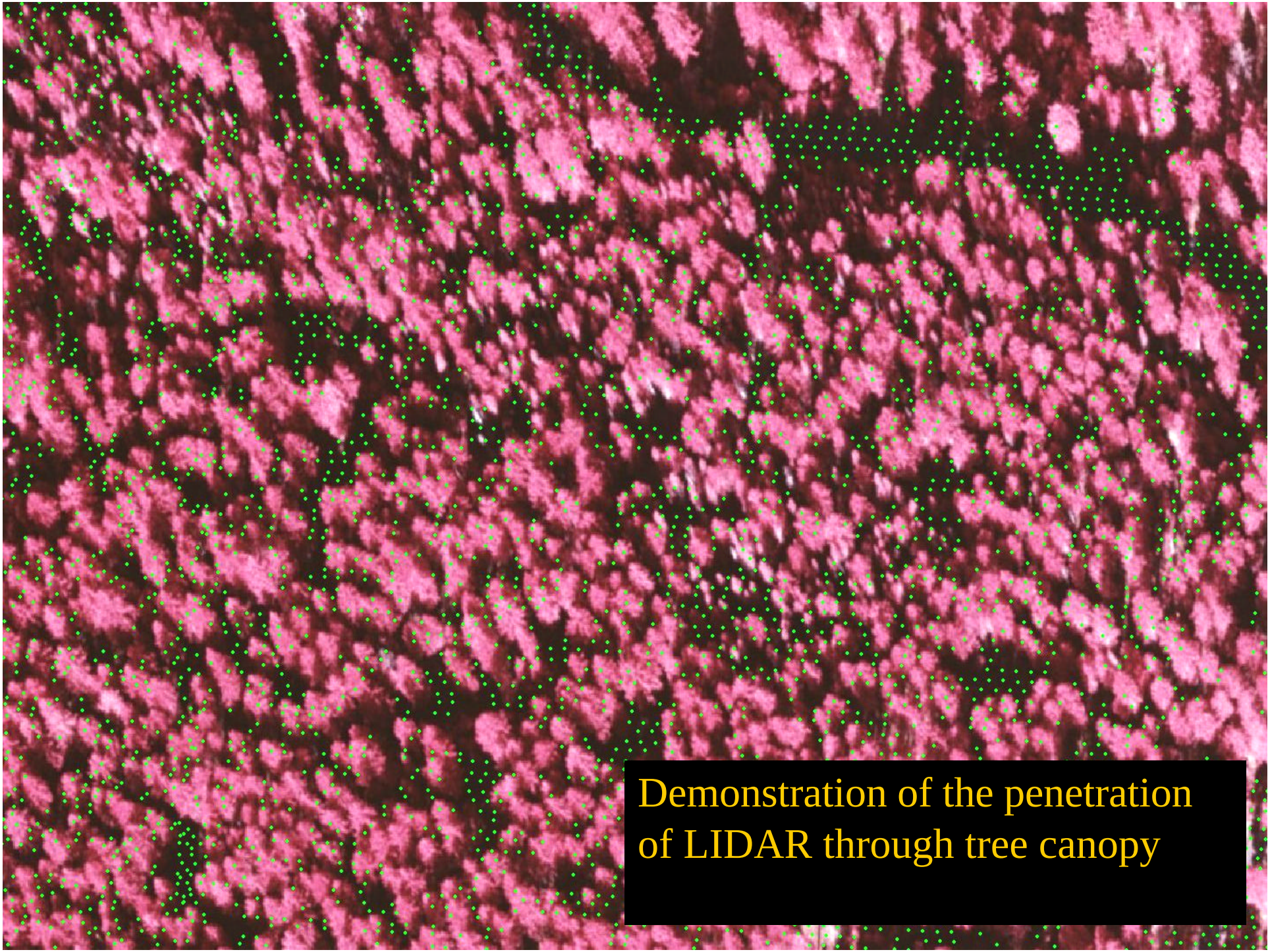
-Laser scan angle: variable up to ±20°, depending on scan rate.

-Operating altitude: 410-2000 m above ground level (AGL)..

ALTM system
A. Laser and IMU,
B. Computer/equipment rack
C. Ashtech Z-12 GPS receiver.

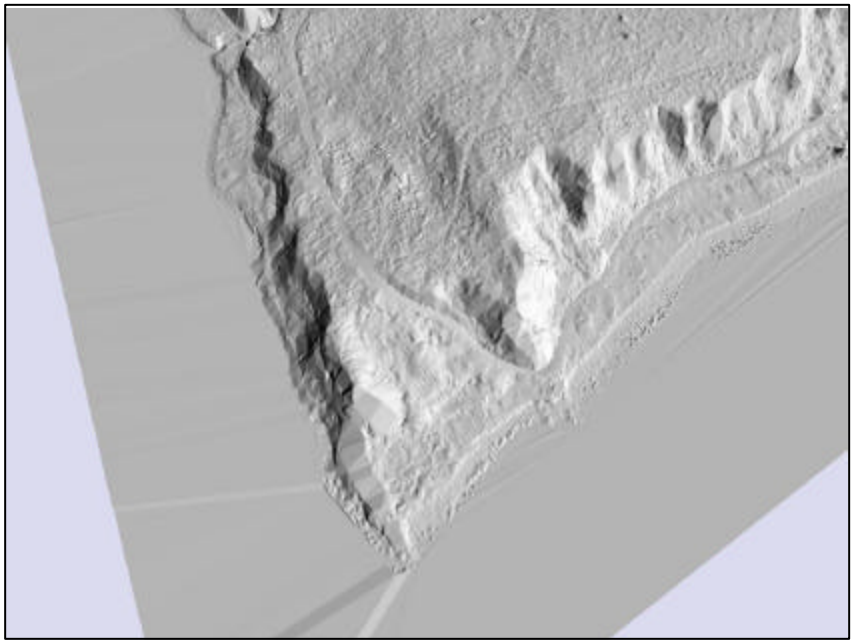
Multiple Return



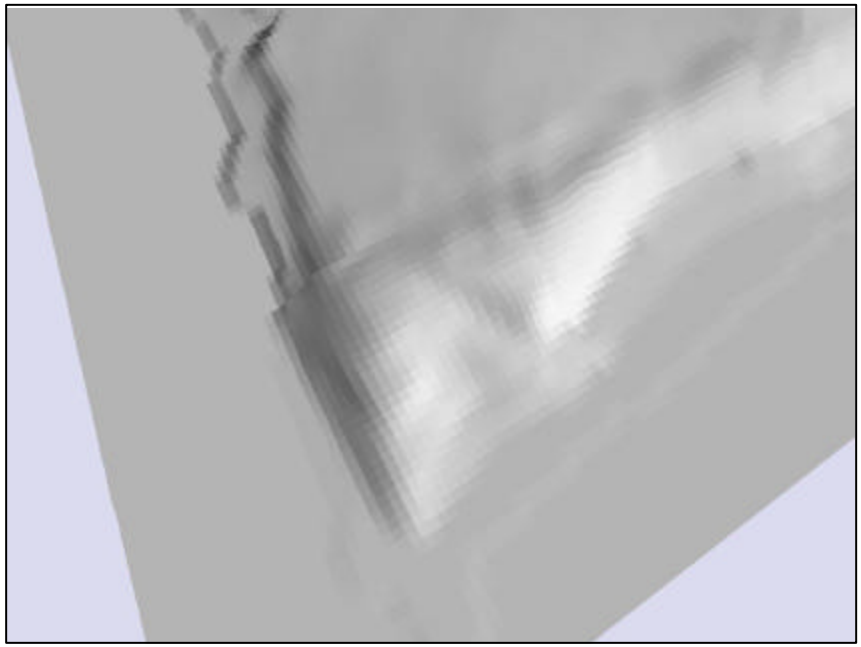

Demonstration of the penetration
of LIDAR through tree canopy

Comparison of Terrain Models
LIDAR and 10 Meter DEM

LIDAR

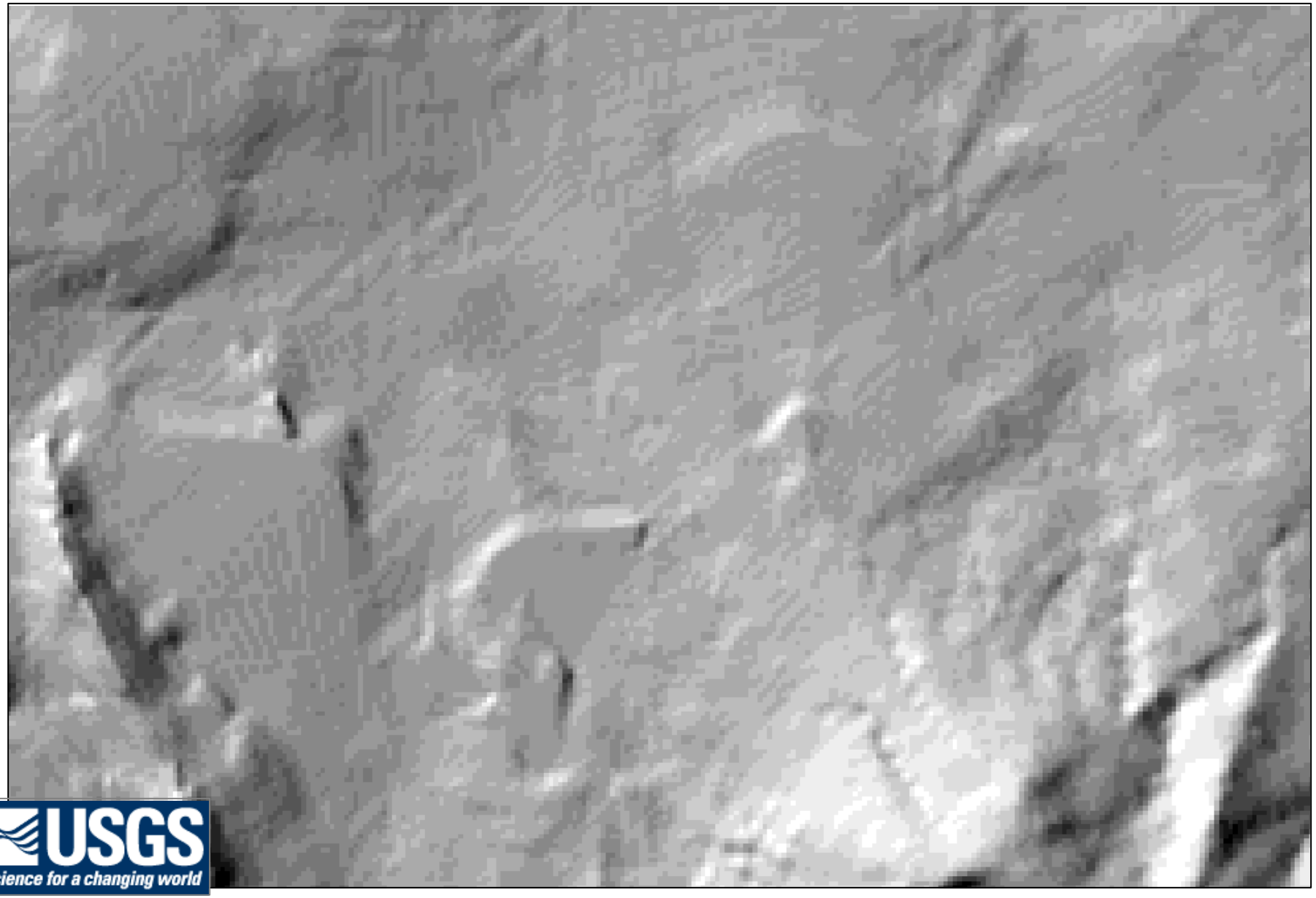


10 Meter DEM



Images from **Puget Sound LIDAR Consortium**

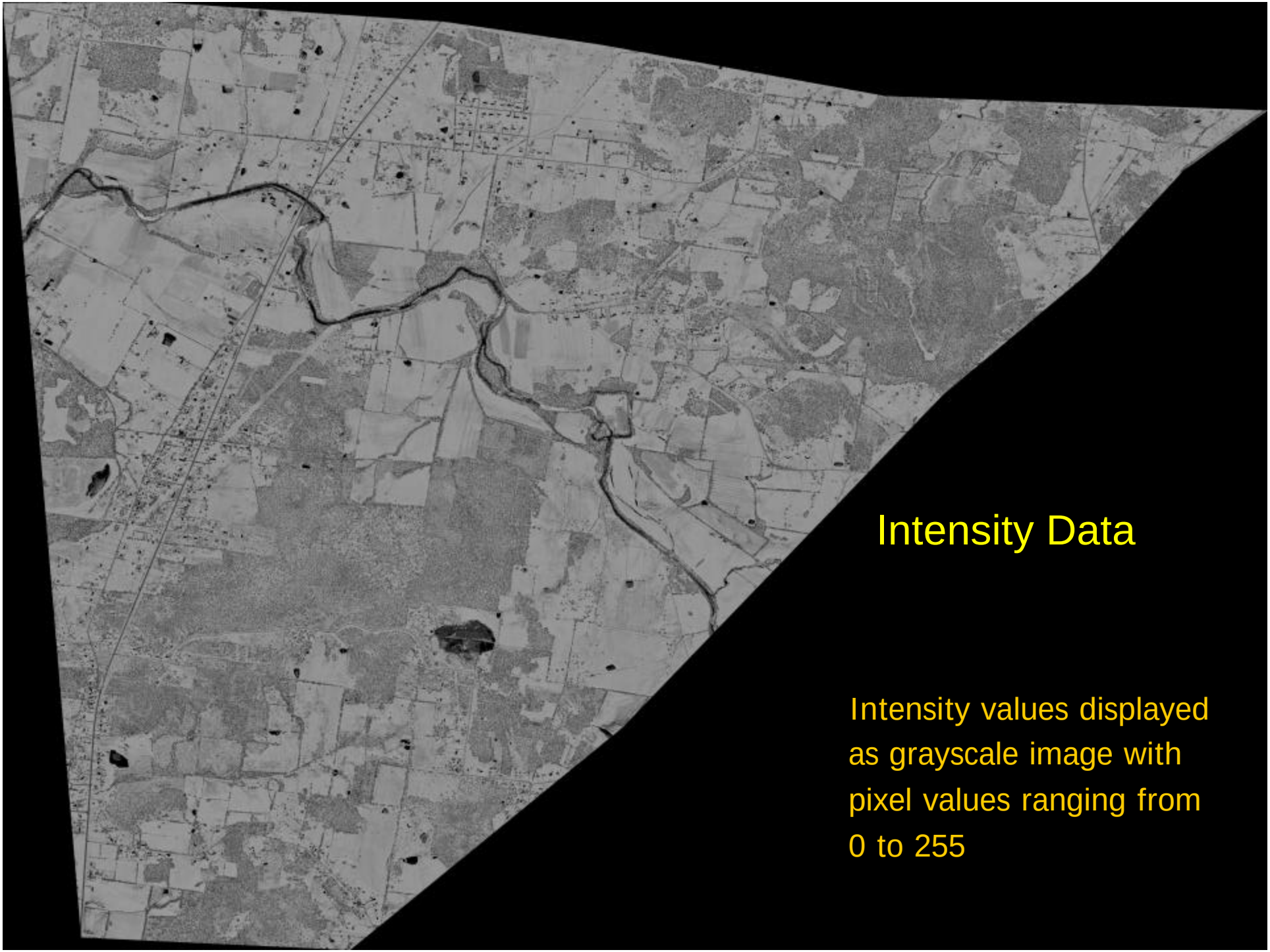
USGS 10-meter DEM



USGS
science for a changing world

LIDAR 2-meter DEM

USGS
science for a changing world



Intensity Data

Intensity values displayed as grayscale image with pixel values ranging from 0 to 255

LiDAR Data

Data Collected in a Single Day's Flight

150-200 million elevation points

1 Gbyte per Hour of LiDAR, GPS, and IMU data.

LIDAR & Photo Collection

LIDAR and photo acquisition should always be performed as close to the same date as absolutely possible.

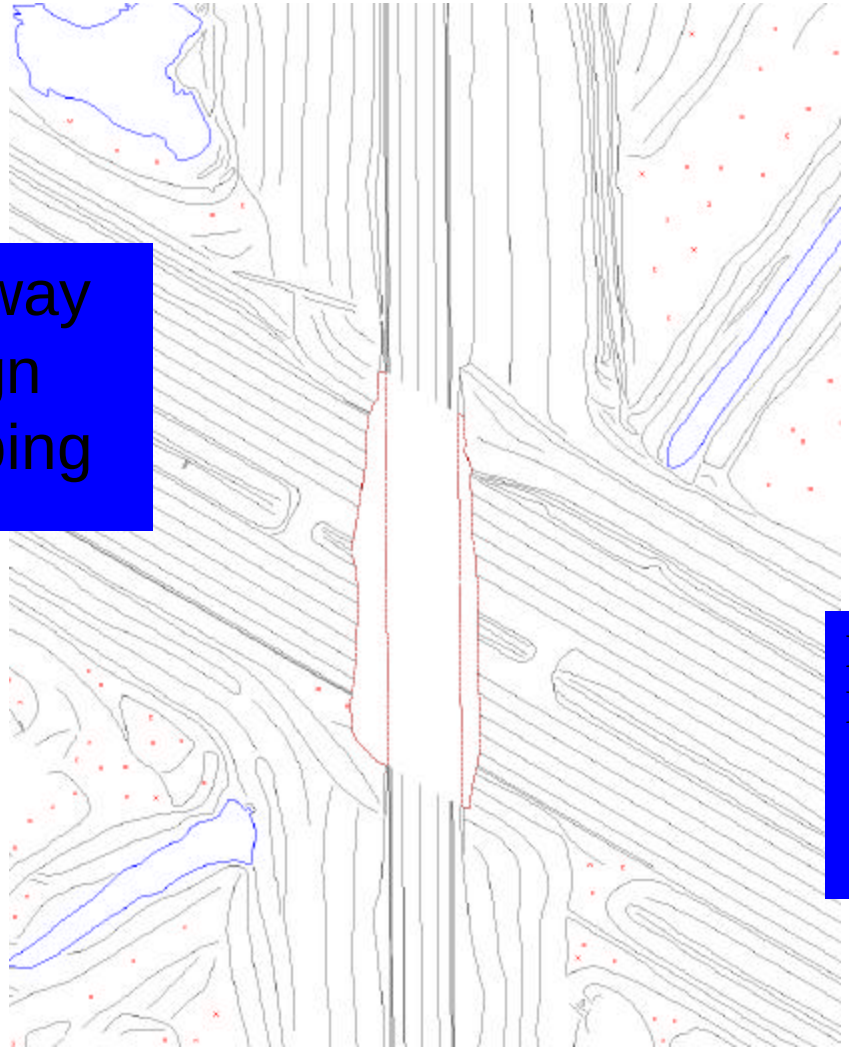
Features may appear absent in the LIDAR when compared to the photos or vice versa.

Water features fluctuate in capacity very rapidly.

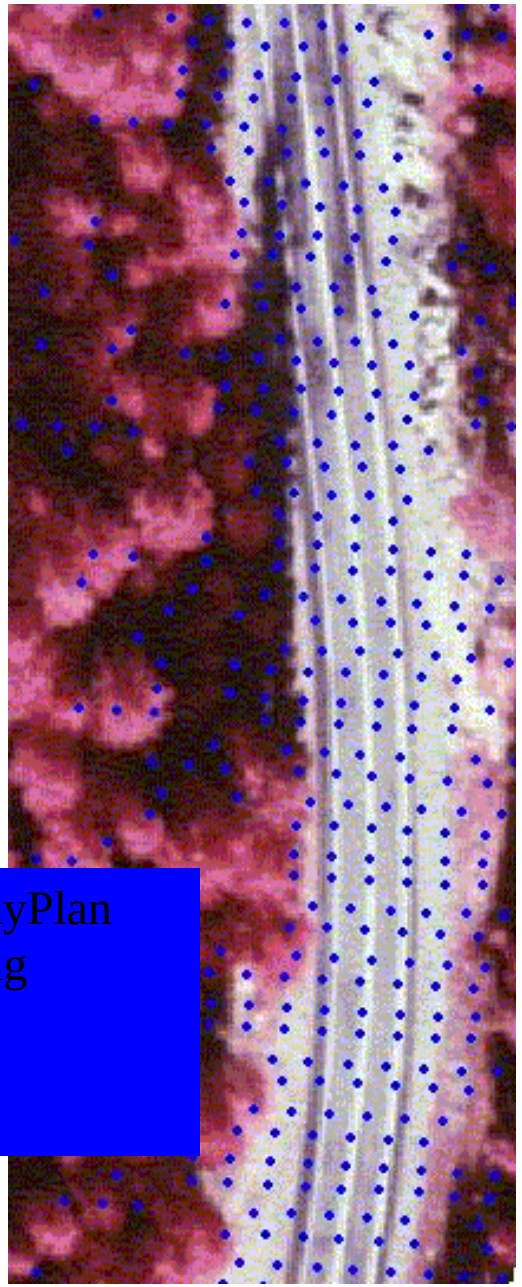
MAPPING APPLICATIONS

Transportation Applications

- Highway Design Mapping



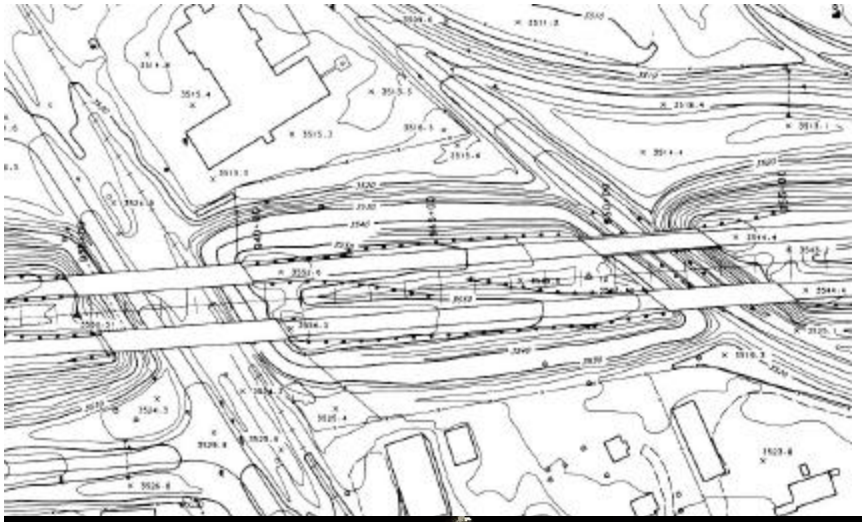
HighwayPlan Mapping

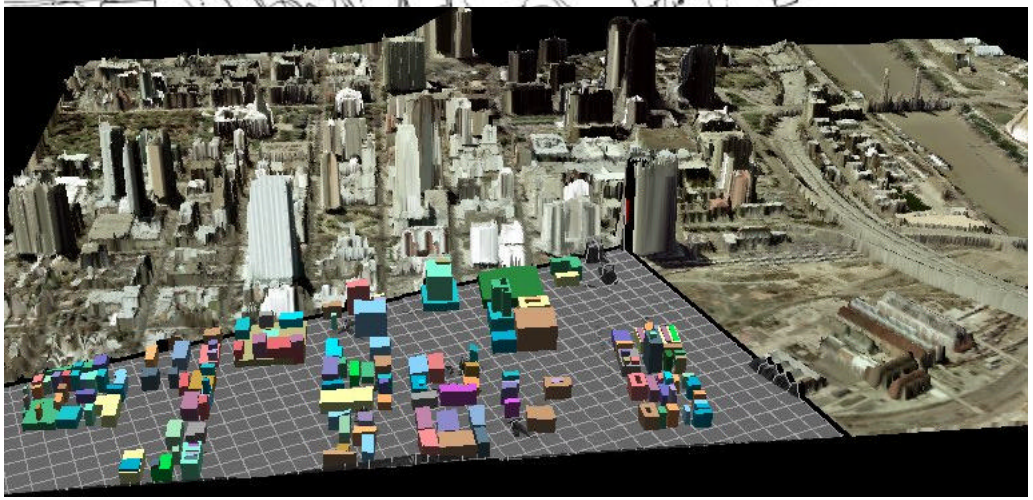


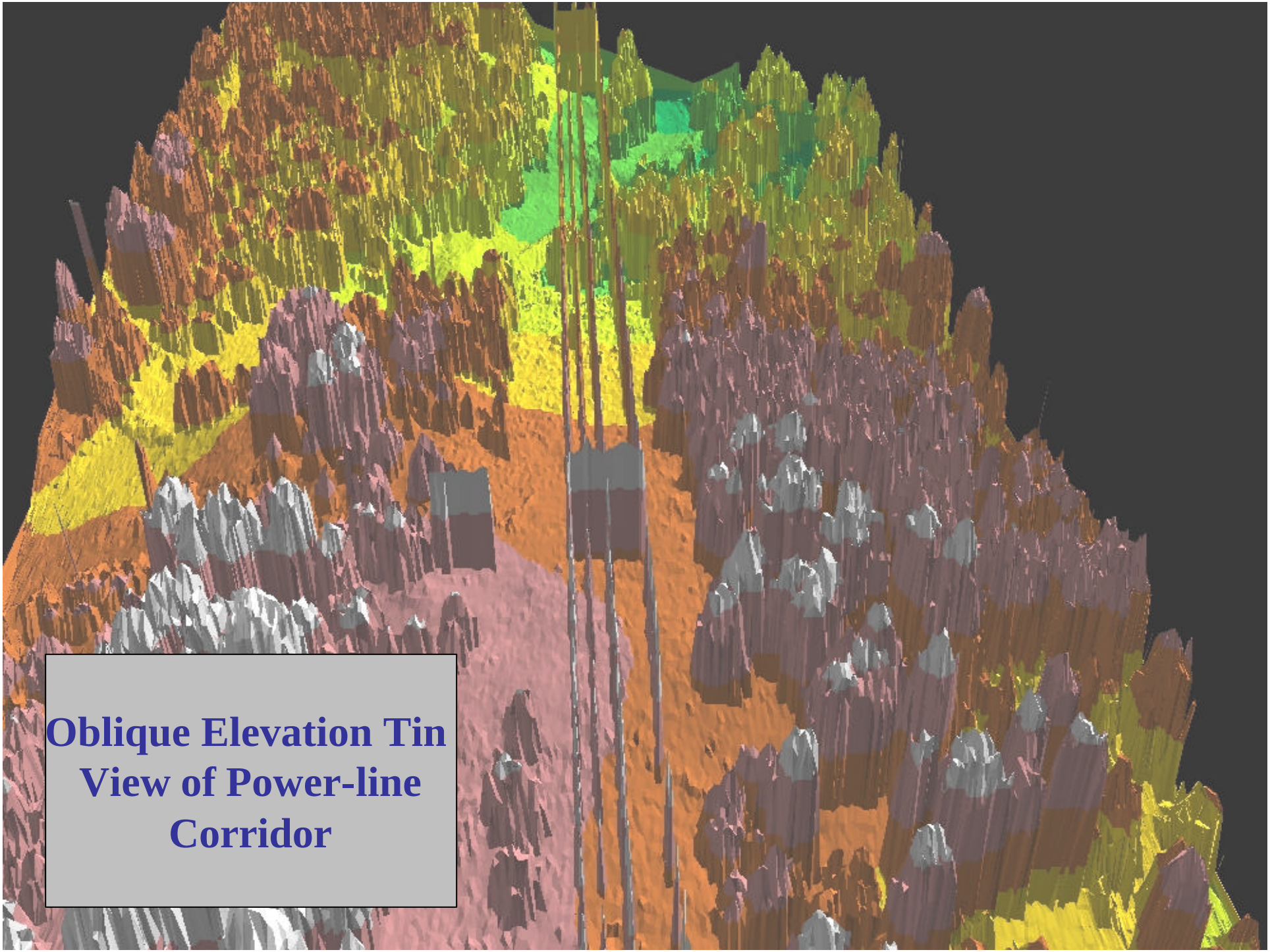
Color Shaded Elevation Model / Image Comparison

Urban Applications

- Contours
- 3D Visuals
- Classification
  - Structures
  - Vegetation
  - Bare Earth
  - Water
- Orthophoto
- DEM



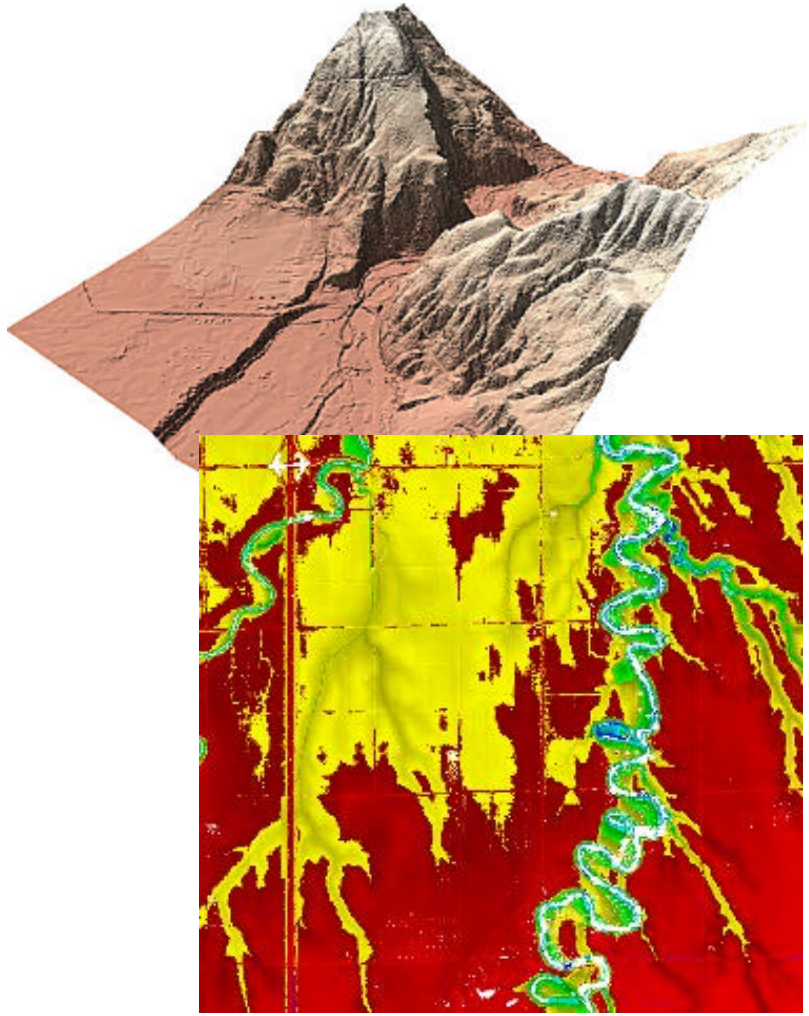




Oblique Elevation Tin View of Power-line Corridor

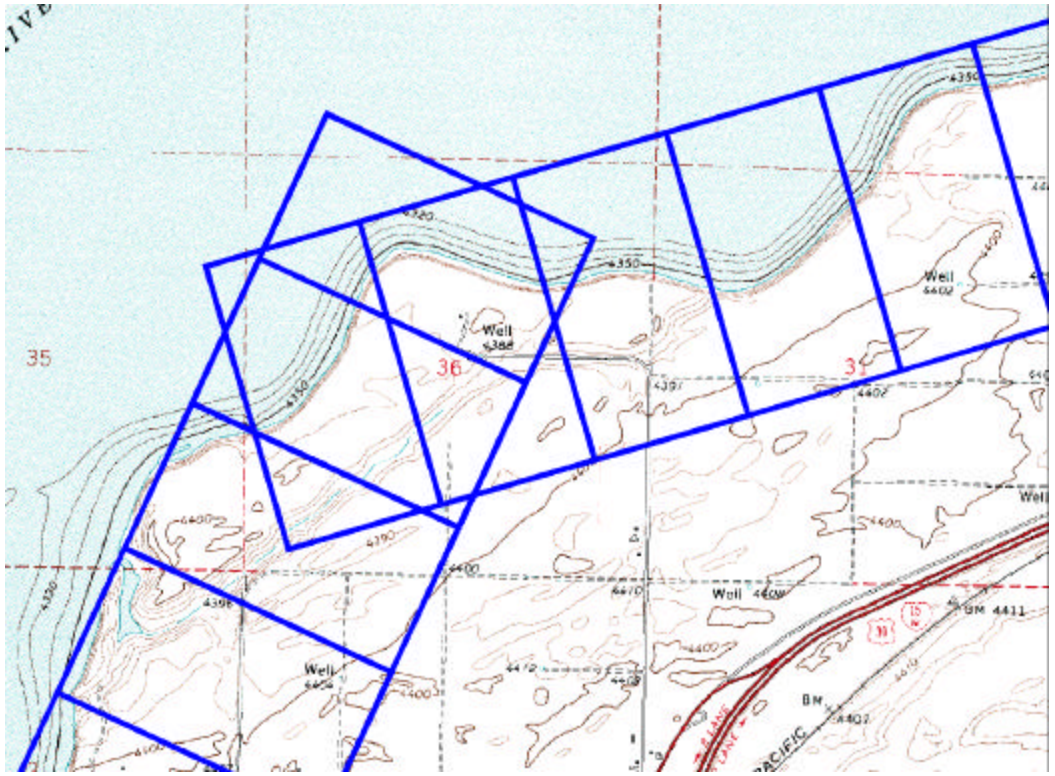
Watersheds and Floodplains

- Economic Solution for Large Area Elevation Models
- Supports 2’ contour interval maps
- Meets FEMA specifications with the addition of breaklines

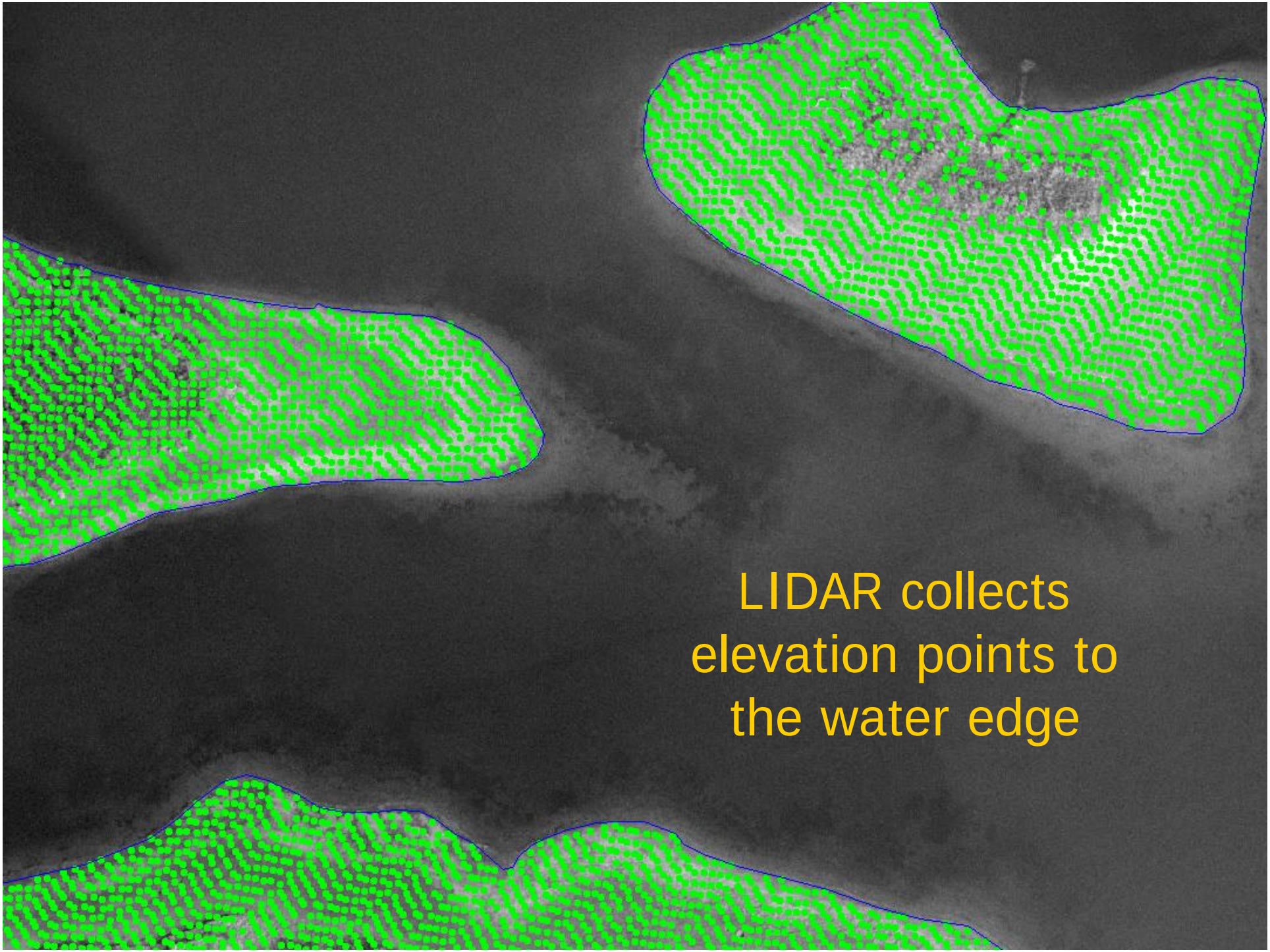


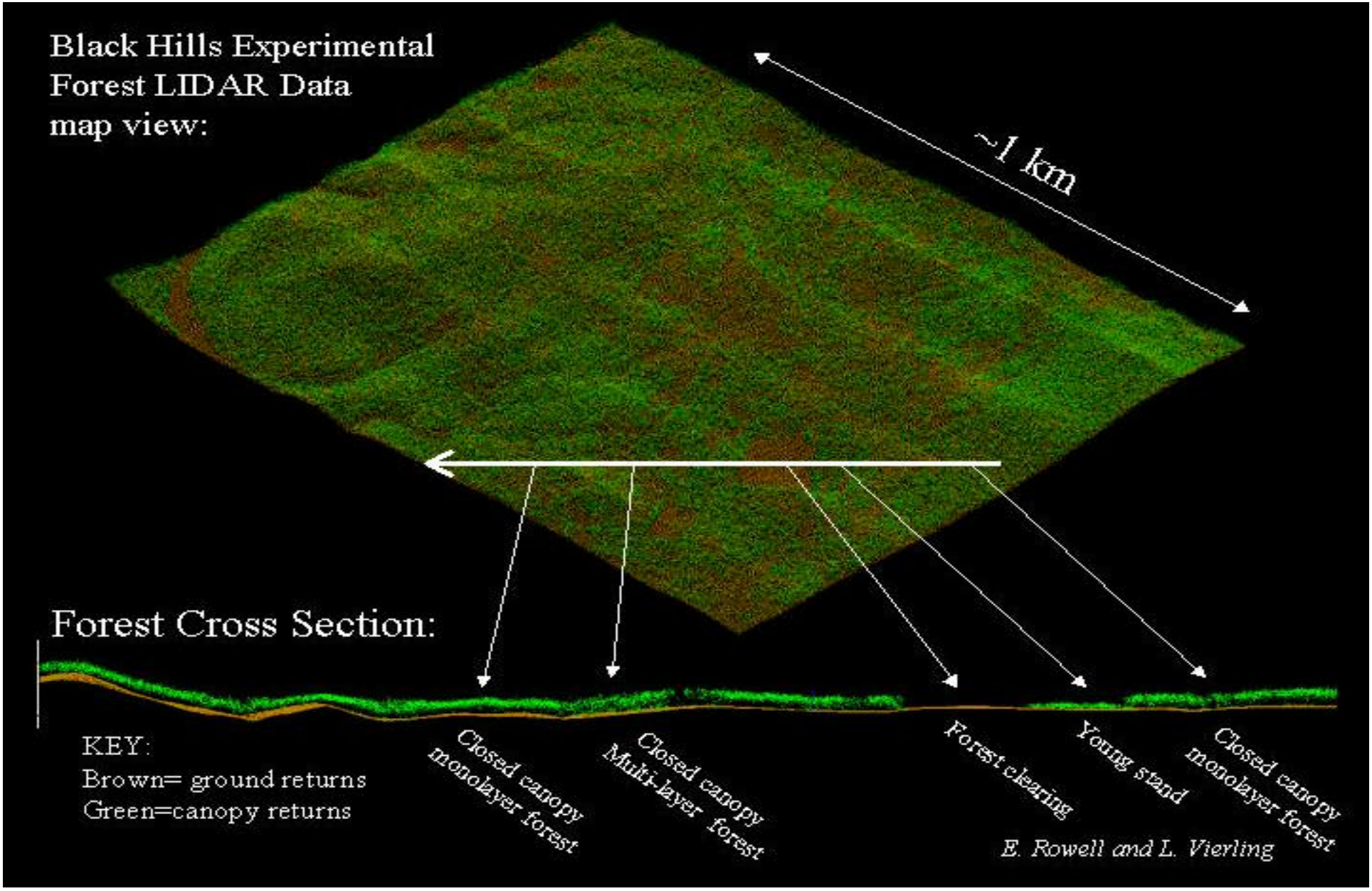
Reservoirs

Challenge to conventional mapping



- Irregular shoreline
- Unpredictable water levels
- Inability to perform photo control across stereo models of water


LIDAR collects
elevation points to
the water edge


Black Hills Experimental
Forest LIDAR Data
map view:
~1 km
Forest Cross Section:
KEY:
Brown= ground returns
Green=canopy returns
Closed canopy monolayer forest
Closed canopy Multi-layer forest
Forest clearing
Young stand
Closed canopy monolayer forest
E. Rowell and L. Vierling

LIDAR Advantages

- Rapid collection of dense topographic data over large areas
- Multiple return capability
- Inexpensive topographic mapping over large areas when compared to traditional photogrammetry
- Much longer annual collection period
- Ability to collect data at night and in shadowed areas

LIDAR Disadvantages

- Smaller projects may be more expensive than traditional photogrammetry due to mobilization costs
- Fog, haze, and extremely high humidity will cause noise pollution in the resulting datasets
- Extreme fields of view tend to produce vibration noise within the datasets
- Limitations on post-spacing

Conclusions:

- **Highly Accurate Remotely Sensed Elevation Data**
  - ~15-cm or 6-inches Vertical Accuracy

- **Becoming Very Cost Effective**

- **Wide Range of Uses**
  - -Flood Forecasting
  - -Reservoir Planning
  - -Changes in Topography
  - -Vegetative Analysis
  - -Wetland Mapping
  - -Urban Modeling
  - -Watershed Modeling
  - -Geologic Fault Mapping
  - -Viewshed Analysis

- **Collect Multiple Datasets on the Same Flight**
  - -LIDAR
  - -Hyperspectral Imagery
  - -Digital Photography

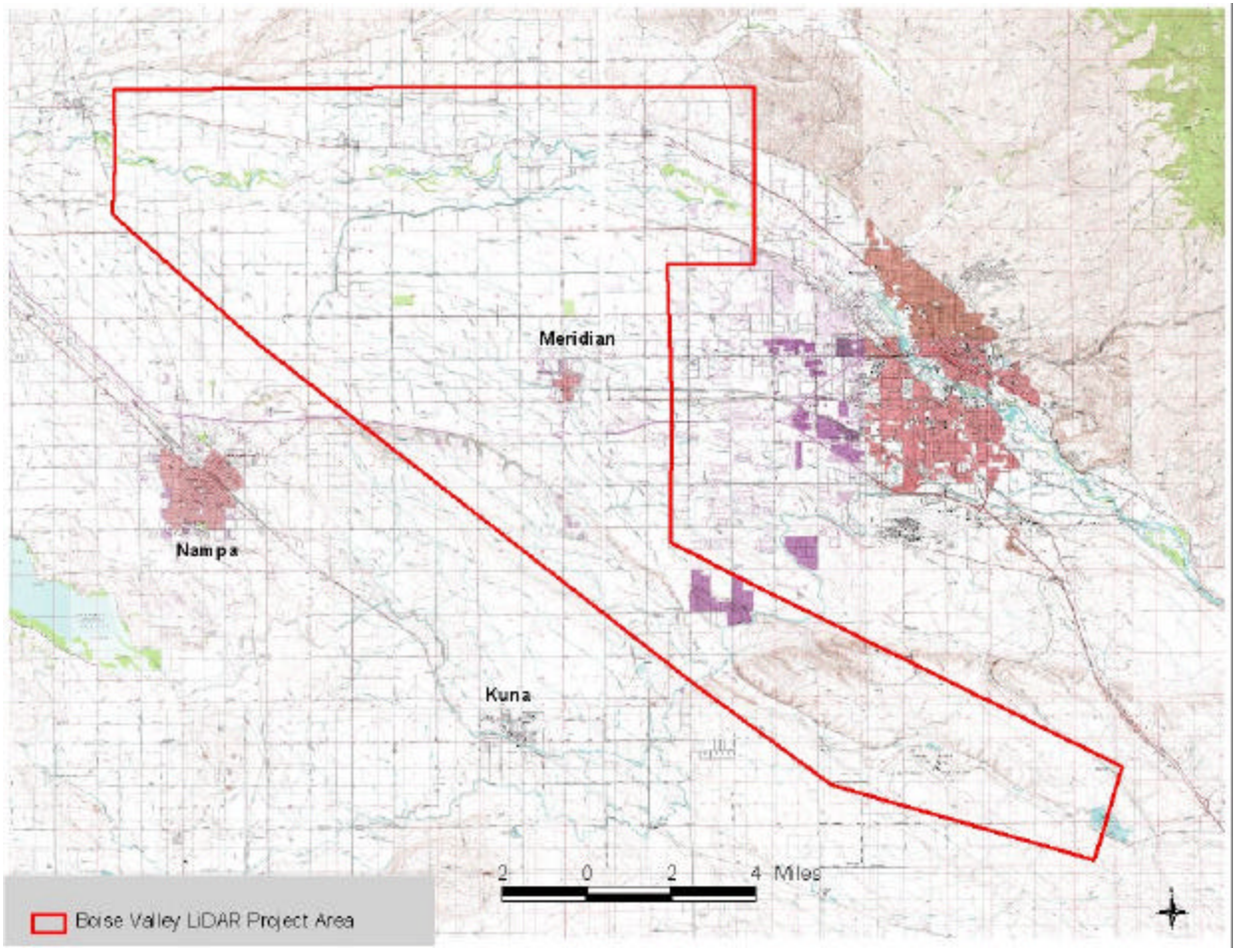
Cooperative Project
USDA – NRCS
USDI – BOR

Need for accurate, detailed DEM

NRCS - Update soil survey (low relief landscape & soil types)

BOR – Study effect of urbanization on drains once used for Ag runoff

Study Area


Meridian
Nampa
Kuna
2 0 2 4 Miles
Boise Valley LiDAR Project Area

Deliverables

- Raw Data
- 1st Return DEM
- Bare Earth DEM
- Intensity Image

Specifications

- Leaf Off
- No Water in Drains or Canals
- November 1, 2003 – March 1, 2004
- < 5% Snow Cover

FY 2004

- NRCS requested additional funding for Boise Valley LiDAR
- BOR may have additional funding
- Looking for additional partners
- Anywhere in state

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